BMH

Air Virtual At Sea (VAST) Platform Stimulation Analysis

Final Report
Concept for Support of ONR/JFCOM

Contract N00014-04-M-0074
CLIN 0001AC

January 2005

CUBIC
DEFENSE APPLICATIONS, INC.
A member of the Cubic Corporation family of companies

Report Documentation Page		Form Approved OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE **28 JAN 2005**	2. REPORT TYPE **N/A**	3. DATES COVERED **-**

4. TITLE AND SUBTITLE **Air Virtual At Sea (VAST) Platform Stimulation Analysis**		5a. CONTRACT NUMBER
		5b. GRANT NUMBER
		5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)		5d. PROJECT NUMBER
		5e. TASK NUMBER
		5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **BMH Associates, Inc 5365 Robin Hood Rd. Norfolk, VA 23513**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES
See also ADM001744., The original document contains color images.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT **SAR**	18. NUMBER OF PAGES **124**	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**			

Outline

- VAST / LVC Integration Concept

- VAST / LVC Integration Architecture

  - Notional

  - Component

- Demonstration Concept

  - Phase 1

  - Phase 2

  - Phase 3 ('06 opportunity)

- Schedule and Cost

- Engineering Management Topics

VAST / LVC Integration Concept

- Goal: Concept exploration of bi-directional stimulation of live, airborne platforms and a synthetic battlespace environment.

- Objective: Enhance LVC infrastructure in the Hawaiian Islands
  - Maui High Performance Computing Center (MHPCC)
  - Kauai Pacific Missile Range Facility (PMRF)

- Extend MSR infrastructure to include stimulation of a generic live node sensor system with virtual and constructive state information

- Integrate newly developed MSR infrastructure into the JTEN

VAST / LVC Integration Approach

- Develop a demonstration concept based on leveraging emergent technologies and existing core LVC technologies.

- Leverage P5CTS development to support platform integration; Use of P5CTS will complement the P5CTS program goals on a non-interference basis
  - Performs early risk reduction for P5CTS in the simulation/stimulation area
  - Uses contractor assets as P5 surrogate hardware for demos
  - Takes advantage of Cubic advanced systems engineering group domain knowledge in TACTS/ACMI especially P5

- As required, reuse/leverage surrogate platform integration technologies (e.g., ASW VAST MRT3, ONR LCASS)

- Leverage standardized JNTC / NCTE simulation/stimulation technologies (to include network infrastructure).

BMH

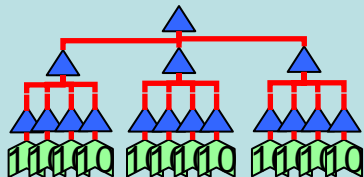# VAST/LVC Integration Conceptual Architecture

Maritime Synthetic Range (MSR)

PMRF
- Airborne Range Platforms
- Subsurface Range Platform
- Range Operations Center

JATTL
- C4I Net
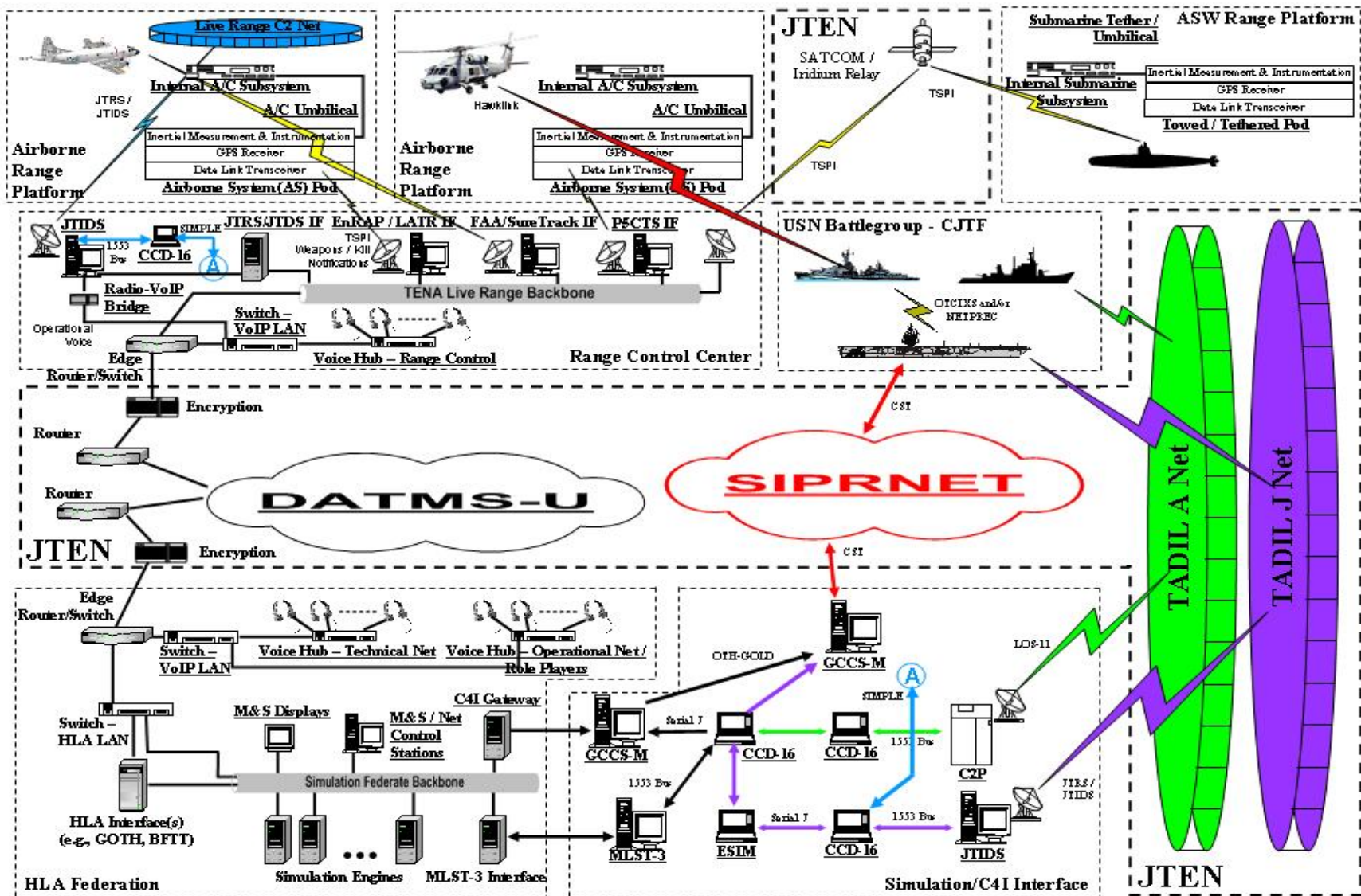- AAR/Debrief Net
- Simulation Net

MHPCC
- Distributed Simulation Clusters

JTEN

JNTC Synthetic Battlespace Environment

VAST/LVC Component Architecture (Notional)

Component Technologies

- ASW Platforms – SH-60B ('05), P-3C ('06), SSN ('06)

- Platform Stimulation - P5CTS, LCASS (like technologies), TATS, range voice communications and circuits

- Platform Interface – P5CTS, LCASS, Towed Array Antenna, Organic sensors and transceivers, P5CTS⇔TENA interface

- Networking - JTEN, SDREN/DREN, TENA⇔HLA interfaces, LVC Bridge

- Simulation – JNTC Toolkit (e.g., JSAF, FAARS, MARCI)

- C4I – Alternative C4I GW, GCCS, TADIL (MLST3)

Demonstration Concept

- ASW mission
  - Technology demonstration
  - ASW training in context of Joint Operations

- Incremental capabilities; spiraling integration
  - Range Integration
    - Airborne platforms
    - Subsurface
  - JATTL/MHPCC Integration

- On- and Off-platform stimulation using distributed computing technologies

- Two Phase Demonstration Approach

Phase 1 Demo Concept

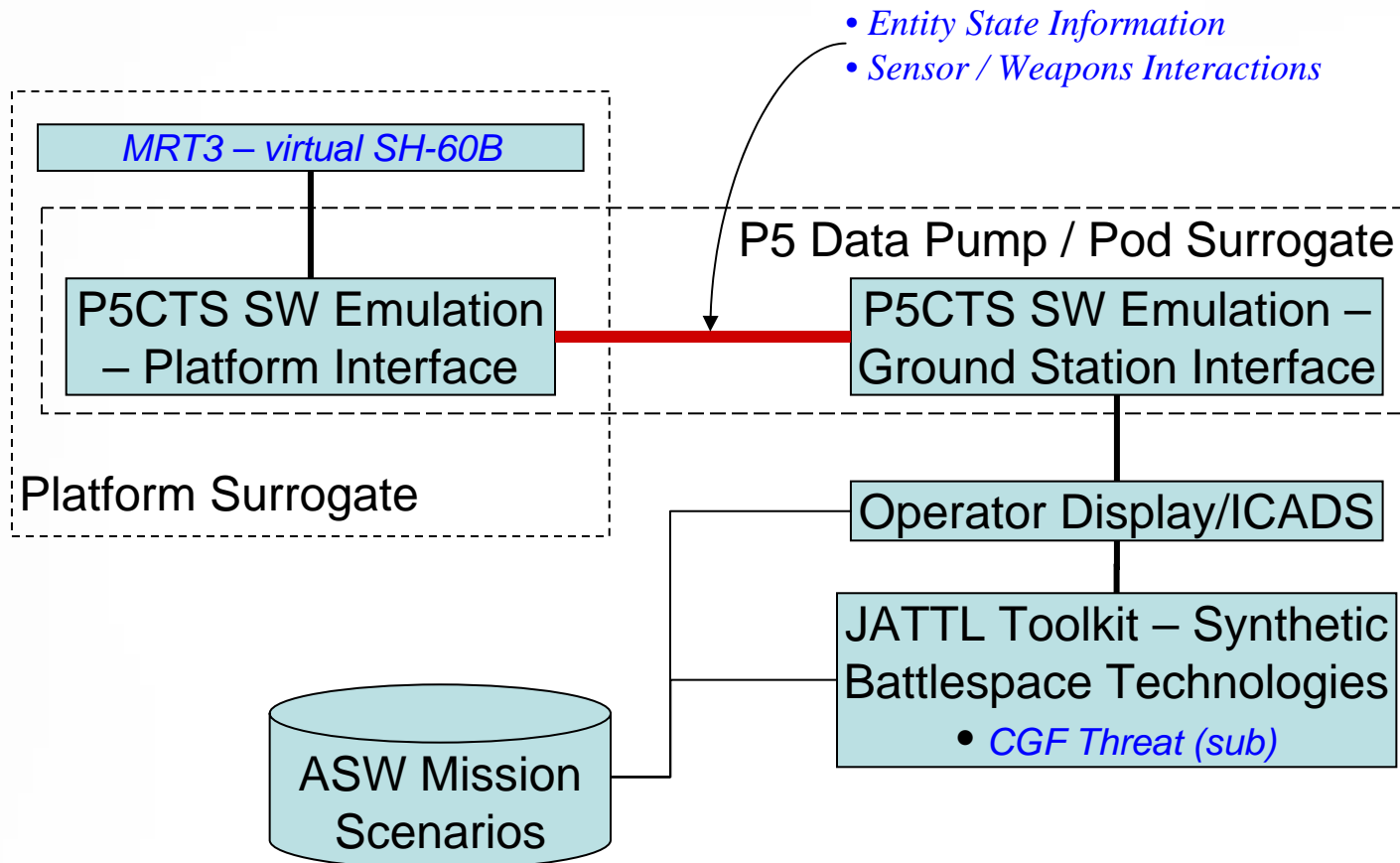- Evolve and develop Use Cases/Scenarios

- Develop Demo System Architecture/SRD

- Develop ASW constructive simulation/stimulation models for SH-60/P-3C and submarine target

- Develop / enhance operator displays to include RWR and ASW views

- Create P5 data pump and integrate with constructive simulator

- Perform Lab Demo of ASW training concept using constructive simulator/stimulator and P5 data pump

Phase 1 Demo Architecture

- *Entity State Information*
- *Sensor / Weapons Interactions*

MRT3 – virtual SH-60B

P5 Data Pump / Pod Surrogate

P5CTS SW Emulation – Platform Interface

P5CTS SW Emulation – Ground Station Interface

Platform Surrogate

Operator Display/ICADS

JATTL Toolkit – Synthetic Battlespace Technologies
- *CGF Threat (sub)*

ASW Mission Scenarios

Phase 1 Demo Technical Approach

- Reuse of ASW VAST / MRT3 (SH-60B)

- Design reusable data model for platform stimulation

- Develop prototype P5CTS SW components required for demonstration of concept

- Modify operator displays and constructive simulation components to manage data flow and component interfaces

- Restrict effort and development activities to SW components and component interfaces
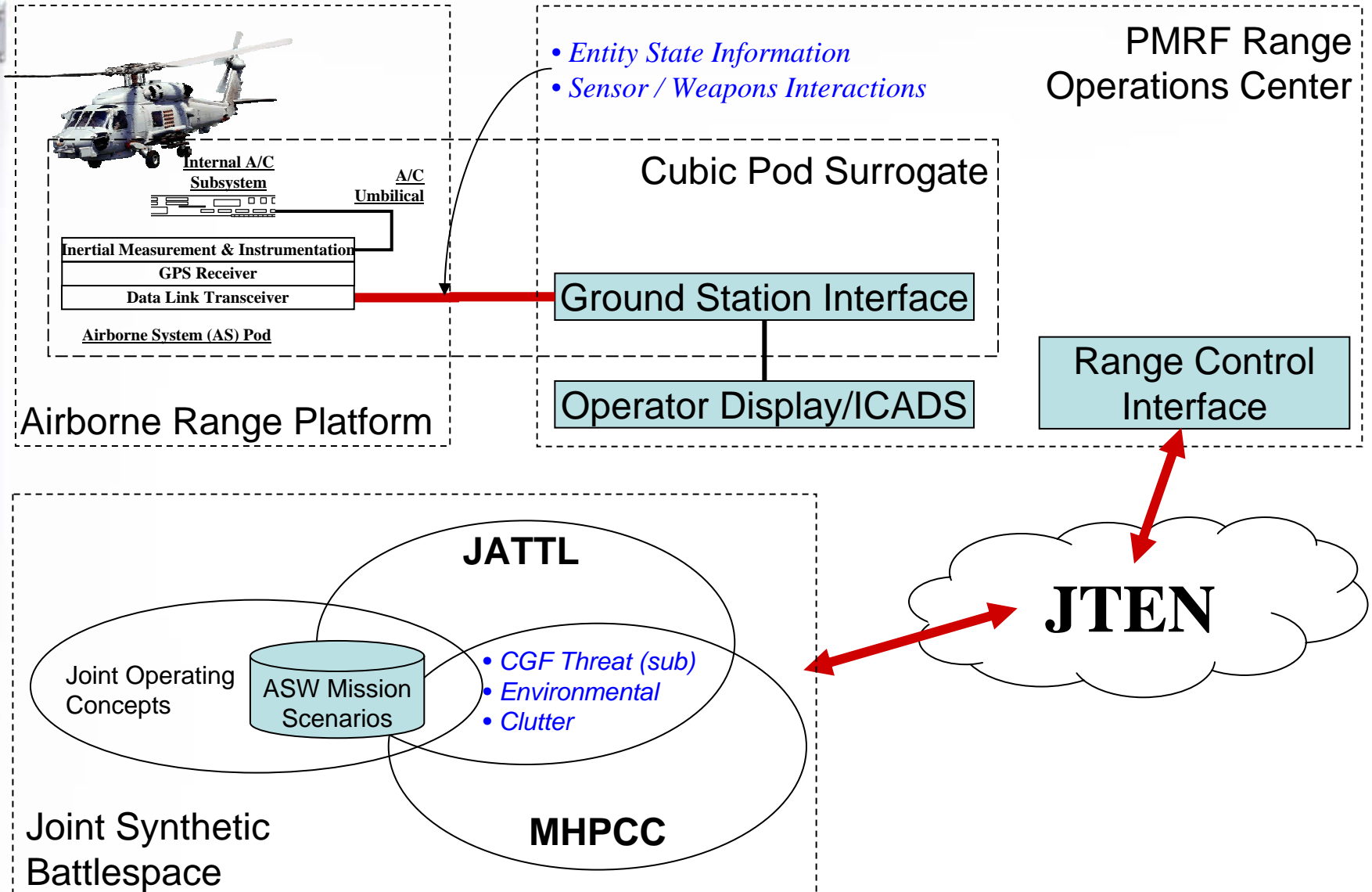
Phase 2 Demo Concept

- Replace ASW VAST MRT3 (virtual simulator) w/ instrumented SH-60/P3C for ASW platform
  - Uses existing Cubic pod inventory
  - Enhance Cubic pods to perform as P5 surrogate

- Integrate PMRF into larger Joint synthetic battlespace using JTEN
  - Develop PMRF⇔TENA⇔HLA Interface
  - Stimulate PMRF airborne platform environment using JATTL Toolkit
  - Utilize MHPCC for large-scale, high-density battlespace; environmental/clutter modeling

- Retain constructive (CGF) threat environment (i.e., submarine target)

Phase 2 Demo Architecture

BMH

• Entity State Information
• Sensor / Weapons Interactions

PMRF Range
Operations Center

Internal A/C Subsystem

A/C Umbilical

Inertial Measurement & Instrumentation
GPS Receiver
Data Link Transceiver

Airborne System (AS) Pod

Cubic Pod Surrogate

Ground Station Interface

Operator Display/ICADS

Range Control
Interface

Airborne Range Platform

JATTL

Joint Operating Concepts

ASW Mission Scenarios

• CGF Threat (sub)
• Environmental
• Clutter

JTEN

Joint Synthetic
Battlespace

MHPCC

CUBIC
DEFENSE APPLICATIONS, INC.
A member of the Cubic Corporation family of companies

Demo Phase 2 Technical Approach

- Utilize Cubic Pod surrogate technologies to integrate PMRF airborne range platform

- Demonstrate stimulation of aircraft subsystems

- Integrate platform stimulation at Mayport NS, NAS Jax, or NAS North Island

- Develop key PMRF network/data interfaces based on JATTL interoperability requirements

- Demonstration scenario to incorporate JNTC-based Joint Operating Concepts that include ASW operations

BMH

CUBIC
DEFENSE APPLICATIONS, INC.
A member of the Cubic Corporation family of companies

Demo Phase 2 Risks

- Risk: Availability of airborne platforms
  - Mitigation: Use of virtual surrogates; modify end-to-end architecture to include reusable components

- Risk: Availability of P5 hardware
  - Mitigation: Use of LCASS technologies as HW surrogate

- Risk: Aggressive development schedule
  - Mitigation: Technology leveraging/reuse
  - restrict system capabilities to only show simple dataflow

Demo Phase 3 Concept

- Phase 3 Evolutionary Step ('06 opportunity)
  - Replaces constructive simulated submarine target with live submarine target; integrated in-range and open ocean communications (i.e., acoustic modem and tow array antenna technologies)
  - Field updated system at PMRF and JATTL facilities
  - Adds a AF asset such as E3
  - Generate report on lessons learned and risk mitigation recommendations for sustaining Joint / ASW mission training capabilities

- Phase 3 Baseline
  - Retains instrumented SH-60 or P3C for ASW platform with surrogate P5 hardware
  - Uses TENA and JTEN for link between JATTL and PMRF

POA&M

- Plan of Action and Milestones   + 45 Days

  – Outlines major MSR/JTEN engineering milestones

- Systems Requirements Document (SRD)   + 60 Days

- Architecture (DODAF Views)   + 9 Months

- System Integration and Test Plan   + 10 Months

- Demonstration   + 12 Months

ROM Cost

- Labor   - $400,000

- Travel   - $ 20,000

- ODC   - $ 5,000

- Hardware   - $ 60,000

- Contract Service - $ 15,000

- Total   - $500,000

Critical Engineering Management Activities

- Project Management Planning
  - Schedule management
  - Recurring technical risk assessment and mitigation
- Requirements analysis / Architecture development
  - Focus on functional vs. non-functional requirements
  - Emphasis on technical requirements for key interface components
  - Identify high-value (meaningful and useful) data exchanges to effectively demonstrate stimulation of platform subsystems.
- Incremental integration and test processes
  - Required to effectively manage complex scope of component interfaces
  - Tight feedback loop with management planning (i.e., risk management)
- Control of HW/SW releases and system documentation (CM)
  - Coordination with other programs developing dependent technologies
  - To provide sustainment of demonstration capabilities and support transition/evolution of integrated VAST and LVC technologies

Sustaining Infrastructure

- Architecture and concept
  - Develop conformant w/JNTC std. (DoDAF)
  - Develop CONOPS for service specific mission training w/JTT

- Pod interfaces
  - Establish technical migration path to utilization of P5CTS technologies
  - Develop prototype operational configuration and control components

- JATTL interfaces
  - Develop baseline networking / data translation technologies
  - Maintain within the existing JATTL CM framework / infrastructure

- Integration methodology
  - Documented procedures and technical integration plans
  - Appropriate methodology to manage classified and secure integration w/JATTL

Summary

- A feasible approach exists to integrate operations of PMRF range platforms with JATTL to support Joint training

- Engineering solution relies on the reuse and leveraging of existing/emergent technologies

- An achievable plan exists to demonstrate the concept of VAST / LVC Integration

- The proposed VAST / LVC Integration can be achieved
  – Low-to-moderate technical risks
  – Moderate-to-high schedule risks
  – Low-to-moderate risk within proposed funding